

The First Mesozoic Vespidae (Hymenoptera) from the Southern Hemisphere, Botswana

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Abstract.—The first Mesozoic vespid (Euparagiinae) from the southern hemisphere, *Curiosivespa orapa* sp. nov., is described from deposits of middle Cretaceous age from Botswana. New information on skeletal features and probable sexual dimorphism in the genus are provided. Its presence in the southern hemisphere suggests that the subfamily had a cosmopolitan distribution 90 million years ago, but conclusions on areas of origin of the subfamily and the family await better information, especially on austral fossils.

All of the known Mesozoic fossils of Vespidae were recently surveyed by Carpenter and Rasnitsyn (1990) and Wenzel (1990). They comprise 11 species in three genera, *Priorvespa* Carpenter and Rasnitsyn (Priorvespinae), *Curiosivespa* Rasnitsyn (Euparagiinae) and *Celliforma* Brown (Polistinae or Vespinae, based on a nest only). These fossils are all from the northern hemisphere: Mongolia, the Buryatskaya Republic and Chita Region in Russia, Kazakhstan, and Utah in the U.S.A. There are almost 50 sites which have yielded Cretaceous insects, of which only about six are in the southern hemisphere (Hennig 1981; Grimaldi and Maisey 1990), and most of the latter have scarcely been reported on, so our knowledge is still highly fragmentary. Darling and Sharkey (1990) tabulated all known Cretaceous Hymenoptera. Only 11 out of the total of 214 species listed are from the southern hemisphere.

Recent excavations at the site of the Orapa Mine, Botswana, have revealed numerous Mesozoic fossils, dated as of middle Cretaceous (Coniacian-Cenomanian) age (Rayner et al. 1991), about 90 million years before the present. They include about 3000 specimens of insects, some of which have been studied by McKay (1990,1991), McKay and Rayner (1986), Rayner (1987), Rayner and Waters (1989,1991) and Waters (1989a, b, 1990). These are either impressions with little or no organic matter remaining or coalified compressions. The Hymenoptera comprise some 3% of the insects (Rayner et al. 1991). Amongst them is a compression of a specimen of *Curiosivespa* (Vespidae, Euparagiinae), of which both the part and most of the counterpart

are present. These were photographed under oblique incident light and also under vertical illumination (fibre-optic ring light) under crossed polarizing filters (using a Wild M400 photomicroscope), and drawn with the aid of a drawing tube using a Wild M8 stereo microscope. The specimen is in a reddish lamination no more than 1 mm thick. Attempts were made to expose the antennae and part of the right wing of the counterpart after it had been photographed. Although this was not entirely successful because of the soft fine-grained nature of the deposits and the extreme delicacy of the fossil, some additional information was obtained; this is included in the line figures and the descriptions.

CURIOSIVESPA Rasnitsyn 1975:113.

This genus now includes five species known from six specimens. The present specimen is only the second to include skeletal features. It is preserved in a different orientation from the other such specimen (No. 2783/261, Kazakhstan, sex undetermined; Carpenter and Rasnitsyn 1990: Fig. 2) and is a female. (The apparent differences in proportions of the flagellomeres and the appearance of the metasomal apex suggest to me that the Kazakhstan specimen is a male.) It provides information, which is probably of generic value, additional to that given by Carpenter and Rasnitsyn (1990). The following generic description is based on theirs, with changes and new information in italics; their paper and figures should be consulted for identification of wing veins and other features

labelled there. Features of the wings are illustrated in Figs. 5-8 and Carpenter and Rasnitsyn (1990: Fig. 1), skeletal features of the female in Figs. 1-8 and of the putative male in Carpenter and Rasnitsyn (1990: Fig. 2). Where I am uncertain about features because of indistinctness in preservation, I have used the word "apparently".

Description.— Body moderately slender; head, mesosoma and metasoma similar in width.

Head with ocellar triangle about equilateral; eyes long, fairly shallowly but angularly emarginate; gena in lateral view moderately wide dorsally, narrow ventrally. Antenna with scape elongate (nearly as long as distance between eyes at level of antennal sockets in female), pedicel somewhat elongate in male but short in female, flagellomeres very slender in male but apparently fairly stout and short in female; clypeus almost as long as wide, dorsal margin apparently very weakly concave and just below lower margin of antennal socket, apex apparently truncate; labrum exposed, almost semicircular, apparently well-sclerotized; antennal socket separated by about 1.2x its diameter from eye; preoccipital carina well-developed, complete dorsally, ending ventrally apparently near level of posterior margin of oral fossa, subocular furrow apparently present; oral fossa apparently broad, extending posteriorly about 0.6x distance to occipital foramen; mandible elongate, probably bidentate apically.

Mesosoma broadly longitudinally oval from above; mesoscutum almost as wide as long, about twice as wide and about 2.7x as long as scutellum; tegula small, apparently broadly oval; scutellum somewhat wider than long, almost oval but tending towards rectangular; metanotum a short posteriorly convex transverse band; propodeum short with posterolateral angles apparently smoothly rounded, anteriorly with a weak transverse carina merging with a median longitudinal carina. Mesopleuron with dorsal groove and lower part of scrobal furrow aligned, precoxal sulcus subparallel to this; metapleuron not constricted at endophragmal pit, lower part (*metepisternum*) well differentiated from upper part (*metepimeron*) and propodeum, with *metapleural sulcus* running anteroventrally from pit.

Fore wing as in *Euparagia* Cresson (first subdiscal cell strongly produced dorsoapically, third (second of Carpenter and Rasnitsyn) abscissa of CuA almost aligned with 1m-cu, first discal cell much longer than subbasal cell, first abscissa of M longer than RS+M, cu-a long and strongly to very weakly curved) except third submarginal cell at most subequal to second in length, not extending as far as apex of marginal cell, and 3rs-m smoothly curved instead

of strongly sinuous. Hind wing with crossvein rs-m strong, convex; free spurs of Rs and M distinct; cu-a straight, long, oblique, inserting on M+CuA shortly before divergence of M and CuA.

Legs fairly long and slender; mid and hind legs with basal tarsomere apparently at least twice as long as any subsequent tarsomere.

Metasoma moderately elongate; first segment probably longer than wide in male but slightly wider than long in female, not petiolate; no evident constriction between segments; female with six visible metasomal segments all similar in length, last segment simple and more or less conical; sting well-developed.

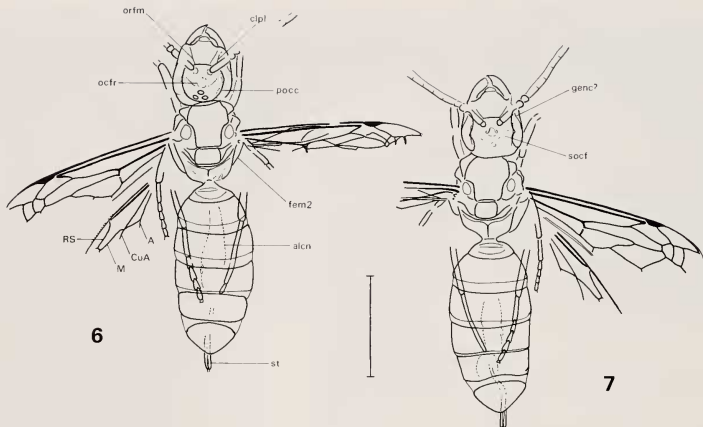
Curiosivespa orapa Brothers, new species

Figs. 1-8

Holotype female.— Size fairly small; fore wing length 10 mm, corrected body length about 13 mm (total length of specimen with head tilted, metasoma distended and sting protruded 17 mm). Metasoma apparently paler in color than head and mesosoma (pronotum and posterolateral areas on propodeum possibly paler also). Integument apparently without coarse sculpture. *Head:* Short genal carina apparently present ventrally; scape length 0.7x eye height, 0.8x distance between eyes at level of antennal sockets; pedicel very slightly wider than long, apparently about 0.5x as long as first flagellomere; first flagellomere length apparently about 0.25x eye height and about 2.0x width, second flagellomere apparently about 0.75x as long and as wide as first, next three flagellomeres each apparently about as long and as wide as second (very rough estimates since limits of flagellomeres very indistinct). *Wings:* Fore wing with pterostigma moderately long, about 3x length of prestigma; R₁ beyond this along wing margin except at extreme apex; second submarginal cell about as long as high, slightly longer than third submarginal, with basal angle almost 90° and at about mid-height of cell; third submarginal cell about 1.5x as high as long; 2m-cu received in second submarginal cell; third (second of Carpenter and Rasnitsyn) abscissa of CuA slightly shorter than 1m-cu; CuA₁ aligned with A at a very obtuse angle; cu-a almost straight, arising well beyond fork of M and CuA, first abscissa of CuA about half length of cu-a; free spur of A distinct. Hind wing with about 15 hamuli; free section of CuA apparently fairly long; fairly short free spur of A present. *Legs:* Mid femur about 0.6x as long as head width, as long as tibia and apparently about 2x as long as first tarsomere; first



Figs. 1-5. *Curiosivespa orapa*, holotype. 1, Part, vertical light, crossed polarizers. 2, Part, oblique incident light from top left. 3, Counterpart, vertical light, crossed polarizers. 4, Counterpart, oblique incident light from top left. 5, Part, left wing, vertical light, crossed polarizers. Scales: Figs. 1-4 = 5 mm; Fig. 5 = 2 mm.



Figs. 6-7. *Curiosivespa orapa*, holotype, left hind wing displaced to display venation. 6, Part (limits of tarsomeres approximate). 7, Counterpart (limits of antennomeres approximate). Scale = 5 mm. Abbreviations: A = anal vein; alcn = alimentary canal; clpl = lateral margin of clypeus; CuA = anterior cubital vein; fem2 = mid femur; genc = probable genal carina; M = medial vein; ocrf = occipital foramen; orfm = margin of oral fossa; pocc = postoccipital carina; RS = radial sector vein; socf = subocular furrow; st = sting.

tarsomere apparently about 0.6x as long as rest of tarsus, second to fifth tarsomeres apparently subequal. Hind first tarsomere apparently about 0.55x as long as rest of tarsus, second to fifth tarsomeres apparently subequal (very rough estimates since limits of tarsomeres very indistinct); hind arolium apparently well-developed. *Metasoma*: Apparently somewhat distended in holotype; first segment slightly wider than long, shallowly conical to campanulate; relative lengths of tergal sclerite apparently about 9:10:11:10:13.

Material examined.— Holotype: BOTSWANA: Orapa Mine, No. BP/2/27125/A (part) and BP/2/27125/B (counterpart), female; deposited in Bernard Price Institute of Palaeontology, University of the Witwatersrand, Johannesburg, South Africa.

Discussion.— This species keys to couplet 3 (*C. curiosa* Rasnitsyn and *C. magna* Rasnitsyn) in the key provided by Carpenter and Rasnitsyn (1990) but is easily distinguished from those species by the insertion of 2m-cu on the second submarginal cell (a condition like that in *C. derivata* Carpenter and

Rasnitsyn) and the almost straight cu-a. It is one of the smallest species, the same size as *C. curiosa*.

Curiosivespa differs from the only other known genus of Euparagiinae, *Euparagia*, in a number of ways. Thus, in *Curiosivespa* body size tends to be somewhat larger (body length more than 12 mm, but less than 9 mm in *Euparagia*; Bohart 1948), the clypeus and labrum are apparently less specialized (clypeus apicoventrally incised and labrum concealed in *Euparagia*), the antennae are relatively much more slender (especially in the male), the forewing has 3rs-m simplified (strongly sinuate in *Euparagia*), the hind wing has cu-a long and oblique (shorter and meeting CuA and A at about right angles in *Euparagia*) and the first metasomal segment is apparently less swollen posteriorly. There is strong evidence that the middle Cretaceous environmental conditions at Orapa were considerably moister and more vegetated than today: a temperate, seasonal, forested habitat with high humidity and close proximity to water is indicated (Rayner et al. 1991). These conditions are probably some-

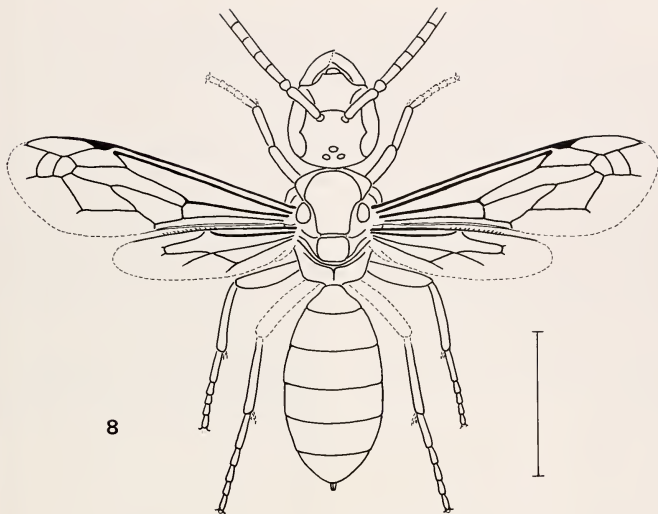


Fig. 8. *Curiosivespa orapa*, reconstruction, dorsal view, head tilted in anterior view (structures for which no information is available in holotype indicated by dashed lines). Scale = 5 mm.

what different from those appertaining in those areas where *Euparagia* occurs, namely the arid southwestern regions of the U.S.A. The two genera may thus also differ in their habitat requirements.

In his analysis of the relationships amongst the higher taxa of Vespidae, Carpenter (1981) postulated that the Euparagiinae had an austral origin on the basis of his cladogram. More recently, on the basis of the apparently exclusively boreal distribution of *Curiosivespa* and *Euparagia*, the only genera included in the subfamily, Carpenter changed his mind and stated that "the subfamily is of Laurasian origin" (Carpenter and Rasnitsyn 1990). The discovery of a specimen which is indubitably a species of *Curiosivespa* of appropriate age (although not as old as some of the Asian specimens) from the southern hemisphere at the very least indicates an early cosmopolitan distribution of the subfamily without any specification of place of origin. The dangers of giving excessive weight to the distribution of fossils in refuting conclusions suggested by cladograms based on modern taxa are thus well

demonstrated. The exclusively boreal distribution of Priorvespinae, the most basal subfamily which is known only from fossils (Carpenter and Rasnitsyn 1990), is suggestive of a boreal origin for the family, but any firm conclusions must await better information on austral fossils.

ACKNOWLEDGMENTS

I am grateful to Dr R. J. Rayner of the Bernard Price Institute of Palaeontology, University of the Witwatersrand, for bringing this material to my attention, providing facilities and assisting in many other ways. The comments of Drs Jim Carpenter, Harvard University (now American Museum of Natural History), Alex Rasnitsyn, Soviet Academy of Sciences, Moscow, and a reviewer on a draft of this paper are appreciated. Financial support was provided by the University of Natal Research Fund.

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